

Provo Reservoir Company
Plaintiff.
vs.
Provo City, et al.,
Defendants.

No. 2888 Civil.

Provo City, Feb. 1, 1915.

Provo Reservoir Company, Plaintiff.
Provo City, et al. Defendants.

Very Respectfully,

(1)

F O R E W O R D

It is to be remembered that a full and complete report on this subject would cover more time and expense than is permitted, or possibly desired at this time.

Therefore the matter herewith submitted is necessarily brief, in some instances the facts are stated without giving their derivation, some conclusions are given without all of the data and groundwork leading up to their determination.

It is hoped, that at least, a foundation has been laid, that may in the future, by someone, be built upon; and that a path has been pointed out, that will eventually lead to a final, proper, and just adjudication of the Water Rights of the Provo River.

I N T R O D U C T O R Y

On May 25, 1914, the Honorable A. B. Morgan, Judge of the Fourth District Court of the State of Utah, appointed T.F.Wentz, as Commissioner of the Lower Division of Provo River.

The Commissioners were appointed to carry into effect the terms of the Stipulation entered into between the parties to this action, on the 25th day of May 1914, and to collect such data as would assist the Court, and the parties to make a final disposition of the waters of the Provo River.

Work was begun on June 1, and ended on Oct. 1. In the early part of the season particular attention was given to the installation of proper measuring and regulating devices. As will be seen from the section of present equipment, there still remains a great deal to do in this line, and unless a specific order is made it is probable this deplorable condition will exist indefinitely.

It is intended to set forth:

- a. The physical facts that form a basis of determination.
- b. The general and specific conditions and practices, with comments as to proper or improper regulation, and the remedy for misuse and unlawful appropriation of water.
- c. The standard of economical and beneficial use, shall be the standard of right and title.
- d. The full and complete submittal of judgement on the vital points.
- e. The duty of water to the Primary Rights, within a safe margin, that a tentative order maybe made pending final settlement.

It is admitted that a statement of an improper practice, without an adequate remedy therefor, is without value.

Where the writer advances judgments and recommendations, or shows faulty conditions, or improper practices that affects the litigants, - approval is neither expected nor hoped for.

SECTION 1.

THE PROVO RIVER.

Descriptive:-

" Provo River rises in the Uinta Mountains and flows Westward in a steep, narrow canyon until it reaches Heber of Provo Valley, through which it winds in a well defined channel. Leaving the valley it flows southwestward, cutting through the Wasatch Range in another steep, narrow, and extremely rough canyon, and finally, discharging its surplus waters into Utah Lake."

"In the mountain regions the principal rock is a compact limestone. Except in Heber Valley little soil is found in any part of the basin. Small groves of fir and aspen are, however, scattered over almost the entire area, and there is a light growth of underbrush. No extensive forests, meadows, or marches exist. In the canyons the stream receives numerous short and swift tributaries, which derive their principal supply from springs, but also a part from the melting of the snow that covers portions of the mountains during the entire year."

Heber or Provo Valley, comprising an area of 24,000 acres, of which practically all is irrigated during the highwater period of each year and more than half irrigated during the whole season, is the second largest farming district on the Provo.

The soil on the higher lands is a sandy and gravelly loam, with a loose subsoil of coarse gravel. In the lower parts of the valley the soil is a sedimentary deposit of a clay loam, rich in humus, with a stiff clay sub-soil.

The application of enormous quantities of water on the higher lands has brought the subsoil to complete saturation, and raised the ground water plane to within a few feet of the surface in the central and lower portions of the valley.

Along the river a well defined and substantial inflow of seepage and percolating water has been established, by the use of such quantities of water on the higher lands. The amount of this inflow is shown by the following:-

Sec. 1.

On July 20, 1914, a tight dirt dam was in place across Provo River, at the Upper Midway Diversion. Below this point and above the diversions of the Utah Valley, approximately 40 second-feet was diverted for irrigation. The discharge at the U.S. geological Survey rating station was 352 second-feet, and from this station to the several points of measurement of the canals in the Utah Valley, there was an inflow of approximately 20 second-feet, making a total available amount below the tight dirt dam of 412 second-feet. Of this amount approximately 90 second-feet flows directly to river from South Fork, North Fork, Deer Creek and Round Valley Creek, the remaining 322 second-feet approximately, derived from inflow from seepage percolation and small springs along river.

From this fact it will be seen that the lower portion of the Provo River, depends largely upon the extent of irrigated area and the amount of applied water in the Provo Valley, and the Provo Valley is by the past practice, and can be in the future by proper manipulation of the waters of Provo River, the storage reservoir of the lower river and the Utah Valley.

The elevation of the Provo Valley ranges from 5,400 to 5,600 feet above sea level, its greatest width is about ~~ix~~ six miles, and its length some 15 miles.

Hay and Grain are raised almost exclusively, however a small area is being used for diversified farming.

The Provo River Enters the valley at its Northern extremity and leaves it at the South-west corner. During flood water season many creeks contribute to the flow of the river, but during the normal irrigating season all of the creeks on both the east and west sides are utilized.

" The section susceptible of irrigation from the Provo in the Utah Lake Valley lies between the lake on the west and the foothills which form the eastern rim of the valley on the east. It extends northward almost to the town of Pleasant Grove and southward to a point 3 or 4 miles South of Provo. The area within these limits approximates 30,000 acres, 18,000 acres of which is a liberal estimate of the area entitled to water from the Provo and which could be irrigated if the water supply of the river were properly controlled.

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The Remaining 12,000 acres are located along the shores of the lake and are of a marshy nature, being saturated by seepage from the irrigated lands above. The land is too wet for cultivation and is used only for meadows and pasture. The irrigable section consists largely of bench lands lying on either side of the river and bottom lands lying along the river's course.

At the point where the river enters the valley it has cut its way through the stepped benches which at different times formed the shore lines of Lake Bonneville, and has made for itself a channel which gradually increase in width as it leaves the mouth of the canyon until, at the point where the benches terminate, the river bottoms have a width of a mile or more. The soil in these river bottoms is an extremely, fertile alluvial deposit. The soil on the bench land,*****, is also fertile but of less depth and more gravelly than the bottom lands, and has a porous subsoil which insures good drainage.

The river, after leaving the mouth of the canyon flows in a southerly direction until it reaches the northern limit of Provo City, then turns in a westerly direction and flows toward the lake, ~~ent~~ entering it 3 miles due west of Provo City.

The canals which divert ~~water~~ below the mouth of the ~~canyon~~ are developed from the ditches that were taken from the river by the settlers who came into the valley in the early days. Those small crooked ditches have from time to time been enlarged, their courses straightened, and in many instances, the points of diversion changed." Extract Bulletin No. 124 U.S. dept. Of Agriculture. The area given is ~~rather~~ larger than our present figures.

At this point a page might be devoted to the history of irrigation along the Provo, but owing to the briefness of this report it is assumed that all parties are partially familiar with this topic.

Secl.

Explanation of River Tables and Plates.

Table I., is a tabulation of the monthly discharge of the Provo, extending from July 1889 to Oct.1, 1914.

The time 1889 to 1900 inclusive is designated the First Period, 1901 to 1914 inclusive, the second period, and 1889 to 1914 inclusive the whole period.

Note:- About the time of the ending of the first period, an extensive area of land was brought under irrigation, in the Provo Valley, and which is fully watered during the season of an available supply.

Rating stations are marked and particularly described.

Records from which compilation is made is noted in margin.

Inflow below rating station and the addition of water to river by the Provo Reservoir Company is noted and the ~~proper~~ proper correction made, that the table shows the natural flow of Provo River and Spring Creek, below the Mouth of the Provo Canyon in the Utah Lake Valley, available for irrigation and waterworks.

For each year ~~minmax~~ twelve combinations are shown, for each month in each of the three periods twelve combinations are shown, for each maximum, minimum, mean, and period, for each of the three periods, twelve combinations are shown, making a total of 876 deductions. The number of months observed in each year and the number of years of each month observed is shown. This table is based on 8,247 observations.

Table II.

Table II is a tabulation of stage duration and the time Flood waters have receded to the 500 and the 400 second-foot stage, it shows the number of days of each month of the irrigating season for the past ten years, the river discharge was between 100 to 200 second-feet, 200 to 300 second-feet, 300 to 400 second-feet, 400 to 500 second feet, and above 500 second-feet.

It shows the total number of days in each month for the ten years of each stage, the maximum, the minimum, and the average number of days in each month for the ten years, the maximum of the flow recession to the 400 and the 500 foot stage. The Minimum of the flow recession to the 400 and 500 foot stage, and the average time ~~of~~ the flood waters have receded to the 400 and the 500 foot stage.

The corrections to observed flow are shown at the head of table.

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Plate I.

Plate I is a graphic ~~xxx~~ presentation of the fluctuations of Utah Lake, the precipitation, and the mean discharge of the Provo River for years as shown, the second feet discharge is shown on the extreme right.

Plate II.

Plate II is a graphic presentation of the fluctuations of Great Salt Lake, the precipitation, and the mean discharge of the Provo River for years as shown, the second feet discharge is shown on the extreme right.

Plate III.

Plate III is a graphic presentation of the "Mean Provo River 1905 to 1914" is based on the natural flow and is corrected for inflow and the diversion to river by the Provo Reservoir Company. & It is the result of 1830 observations. Also is shown by broken line the 1914 Natural Provo River.

Table III.

Table III is the tabulation of the "Mean Provo River" as ~~graphic-~~ *ally shown on* Plate III.

Table IV.

Table IV is a summary of period comparisons, for the months of April, May, June, July, August, and September, it shows the comparative difference of the Second period to the First Period, and the effect of the greater irrigation of the Provo Valley.

SUMMARY OF TABULATION AND PERIOD COMPARISON

Month of April

Table IIII

First Period				Second Period			Whole Period			Comparative Diff. 2nd to 1st Period.		
Max.	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean
Max.	1548	842	885	1600	610	944	1600	842	944	52*	232-	59*
Min	470	310	407	525	278	359	470	278	359	55*	32-	48-
Mean	1083	529	691	991	419	637	1033	469	662	92-	110-	54-

Month of May.

Max	4180	1350	1946	2380	890	1500	4180	1350	1956	1800-	460-	446-
Min	1162	420	987	780	341	508	780	341	508	382-	79-	479-
Mean	2126	857	1358	1623	570	1014	942	700	1171	503-	287-	344-

Month of June.

Max	3375	1484	2375	3660	1670	2290	3660	1670	2375	285*	186*	65-
Min	1988	185	434	753	254	429	753	185	429	235-	69*	7-
Mean	1955	644	1216	1732	605	1062	1839	624	1135	223-	39-	154-

Month

Month of July

Max	1920	360	709	2140	519	1160	2140	519	1160	220*	159*	451*
Min	180	179	180	260	166	235	180	166	180	80*	13-	55*
Mean	728	363	369	656	271	416	690	267	393	72-	92-	47*

Month of August.

Max	474	360	367	498	399	427	498	399	427	24*	39*	60*
Min	179	174	175	179	174	174	179	148	167	000	00	91-
Mean	295	245	261	327	241	272	312	243	267	32*	4-	11*

Month of September.

Max	530	360	460	680	399	484	680	399	484	150*	39*	24*
Min	197	137	180	213	142	183	197	137	180	16*	5*	3*
Mean	332	250	284	348	249	287	340	250	285	16*	1-	3*

* Denotes the second period greater than the first, in second-feet.

- Denotes the second period less than the first, in second-feet.

Sec.2.

Office Provo River Water Commission.

Provo, Utah Sept., 18, 1914.

List of Diversions, and respective measuring devices, Provo River, Provo Division. Compiled by T.F. Wentz.

No.	Name	Measur.	Devise	Date Instal.
100AC	Midway Irrigation Company (Upper Diversion)	8 foot	Cipp. Weir.	
100BD	" " " (Lower ")	6x1 ft.	Sup. Weir.	1914.
100E	" " " Mahogany Springs	None.		
100F	" " " Epperson Springs	None.		
100G	" " " Snake Creek Above Town	12' x 1'	Sup Weir	1914.
100H	" " " Probest Ditch	3 ft.	Rect Weir.	
100I	" " " West Bench Ditch	5 ft.	Rect. Weir.	
100J	" " " Mound Ditch	None		
100K	" " " Lower Springer Ditch	None.		
100L	" " " Upper " "	None.		
101	Ford Ditch (Lewis Ford & Smith Estate)	6" 1' x 6"	Sup Weir.	1914.
101B	Effie Haws Ditch -----	None.		
102	Remund Ditch -----	3' x 1'	Sup Weir	1914.
103	Mitchel Ditch -----	3' x 1'	Sup Weir	1914.
104	Spring Creek Ditch Irrig. Co. & Sage Brush Irrig. Co.	None.		
105A	Charleston Irrig. Co., Upper Branch.	None.		
107	Nelson Ditch -----	3 ft.	rating Flume	1914.
107A	Alder Ditch -----	None.		
108	Averett Ditch -----	None.		
109	George R. Carlile, Sub-irrigates by Backing up Slough.			
110	Hicken Slough (W. Casper, & J Casper)	None.		
111	Watkins Slough (J. M. Casper) -----	None.		
112	Meaks Bottom Slough -----	None.		
113	Van Wagenen Snake Creek Ditch -----	None.		
114	Charleston Midway Ditch -----	None.		
115	Winterton Bottoms Spring Branch -----	None.		
116	River Ditch -----	None.		
117	Springer & Tate Springs -----	None.		
118	Bonner Slough & Soldier Hollow -----	None.		
119	North Drain Ditch -----	None.		
120	Fowers Springs -----	None.		

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List of Diversion, Provo River, Provo Division. And Miscellaneous Points.

No.	Name	Measr. Devise	Date. Inst.
121	W.D.Wright Springs-----	None.	
122	Daybell Springs -----	None.	
123	Richie Ranch -----	None.	
124	Charleston Irrigation Co. Lower Canal -----	None.	
125	Pioneer Irrigation Co.-----	None.	
126	Wright Ranch -----	None.	
127	Allen & McAfee-----	Not complete.	
128	Webster Springs -----	None.	
129	Tate Pasture Drain -----	None.	
117A	Bonner Drain Ditch -----	None.	
202	Provo River Below Upper Midway Dam -----	None.	
201	Snake Creek Weir Below All Diversions-----	5 ft. rect.weir.	
200	Provo River Below Lower Midway Dam -----	None.	
130	John W. Hoover -----	None.	
131	Sam Rieske-----	Not known.	
132	Wildwood Resort Co. -----	None.	
133	Conrad Bros. South Fork -----	None.	
134	Thomas & Giles, South Fork -----	Not Known.	

List of Diversions		Provo River	Provo Division.	
No.	Name.	Measr.	Devise	Date Inst.
1.	Provo Reservoir Company-----	10 ft.	R.Flume.	1914.
1A.	Sego Irrigation Company-----	3' x 1'	Sup.Weir.	1914.
2.	Timpanogus Canal Company -----	7 ft.	rating flume	
3.	Provo Bench Canal & Irrigation Co.-----	15ft.	rating flume & Register.	
4.	West Unoin,Smith Ditch,& Carter Ditch (jointly)	12' x1'	Sup Weir	1914.
5.	River Bottoms.			
5a	Barton & Young Ditch -----	3' x1'	Sup.Weir.	1914.
5b	Par & Nuttal Ditch -----	3' x1'	Sup. Weir.	1914.
5c	Henry Smith Ditch No 1. -----	None.		
5d	John Gordon Ditch -----	3'x1'	Sup.Weir (incomplete)	
5e.	MrsJensen Ditch -----	None.		
5f.	Smith Ditch No.2 -----	None.		
5g.	Startup Ditch -----	None.		
5h.	Richmond Ditch -----	3' x1'	Sup.Weir (incomplete)	
5h 2.	Richmond Ditch No.2. -----	None.		
5i.	Ferguson Ditch No.4. -----	3' x1'	Sup.Weir (Incomplete)	
5j.	" " No.3. -----	3' x1'	Sup.Weir (incomplete)	
5k.	Ferguson Ditch No.1. -----	2' x1'	Sup.Weir (incomplete)	
5l.	" " No.2. -----	3' x1'	Sup.Weir (incomplete)	
5m.	Booth Meldrum Ditch -----	3' x1'	Sup.Weir (incomplete)	
5n.	West Booth Ditch -----	None.		
5o.	Jacob Baum Ditch -----	3' x1'	Sup.Weir (incomplete)	
5p.	George Baum Ditch-----	None.		
5q.	Thomas Foote Ditch -----	None.		
5r.	Barnett Ditch -----	None.		
6	Upper East Union & Fausett Field (Jointly) ---	8 ft.x1 ft.	Sup Weir	191
7	Upper East Union -----	8 ft.	rating flume.	
8	Provo City.			
a.	East Unoin -----	7.73'	x1' Sup.Weir	1914
b.	Factory Race -----	16 ft.	rating flume.	
c.	City Race -----	8 ft.	rating flume.	
d.	Tanners Race -----	7.96'	x1'Sup.Weir.	1914
e.	Young Ditch -----	None.		
f.	Cluff & Dixon Ditch -----	None.		

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List Of Diversions, Provo River, Provo Division.

No.	Name.	Measuring Devise	Date Inst.
8g	Provo City Waterworks system.		
9	Little Dry Creek Irrigation Company -----	5 ft.rating flume.	
10	Lake Bottom Canal Co.- -----	10 ft.rating flume.	
11.	Fort Field Irrigation Co.-----	3 ft. rating flume.	1914.
12.	Spring Creek Diversions.-----		
a.	Tanner Farm Flume Ditch -----	Rating Flume.	
b.	Tanner Farm East Ditch -----	Rating Flume.	
c.	Tanner Farm West Ditch -----	2 ft. Cipp. Weir.	
d.	Clyde Ditch -----	3' x1' Sup.Weir.	1914.
e.	Clyde Davis Ditch -----	Rating Flume.	1914.
f.	Roy Brown Ditch -----	3' x1' Supp.weir.	1914.
g.	Stephen Jones Ditch -----	Rating Flume	1914.
h.	Partridge Ditch -----	Suppressee Weir.	
i.	Asther Taylor Ditch -----	None.	
j.	George Taylor Ditch -----	None.	

Sec.3.

(Copy. of Copy)

Mr. R.J.Murdock, President,
Provo, Reservoir Company,
Provo, Utah.

Dear Sir;

A preliminary estimate of the land irrigated under the ~~various~~ various canal systems by the Provo River in this Valley as tabulated from my investigations, is as follows:

Provo Bench System:

Provo Bench Canal & Irrigation Co:

Wentz &) Highwater-----	2711.16	Acres.
Stewart) Low-water-----	2042.34	"

North Union Irrigation Co:

Wentz &) Highwater	1621.37	"
Stewart) Low water.	1038.81	"

Timpanogus Canal Co:

Wentz &) High water	846.98	"
Stewart) Low water	708.53	"

Upper East Union Canal Co:

Probably not to exceed	762.18	"
----------------------------------	--------	---

Provo City, including East Union: Excluding road areas, most of First Ward Pasture, swamps and meadow. Probably less than	2682.20	"
---	---------	---

River Bottoms, Exclusive of Faucett Field	516.00	"
---	--------	---

Faucett Field	108.75	"
-------------------------	--------	---

Dry Creek, probably less than	506.00	"
---	--------	---

Fort Field , probably not to exceed	574.30	"
---	--------	---

Lake Bottoms, probably not to exceed	1275.00	"
--	---------	---

West Union, including Smith Ditch: And Carter ditch, estimated at 430.0 acres, Probably not to exceed.	1900.00	"
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Under the last three named canals systems there are additional areas served from seepage and from artesian wells.

Very Respectfully,

Scott P. Stewart.

(Copy of Copy.)

Sec.3.

~~Copy.~~

Copy.

Provo, Utah, Jan. 2, 1915.

Mr. T.F. Wentz, Com.,
Provo River,

Provo, Utah.

Dear Sir;

In reply to your verbal inquiry
regarding the total irrigated ares under
Spring Creek Branch of Provo River, you
are advised that there are under irrigation ~~272~~
276 acres.

Yours Truly,

(Signed) Frank S. Allen

Engineer.

Sec.3.

Copy.

Provo City,Utah,September 23rd,1914.

Mr. Frank Wentz,

Deputy Commissioner for Provo River.

Provo City,Utah

Dear Sir;

The following is a statement of the lots and lands
irrigated under the Irrigation system of Provo City.

Total acres	1991.81
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Total lots	1789.42
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equivalent to an acreage of	3781.23
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It requires as much water for a city lot as for an acre of farm land
measured at the head of the ditch.

Respectfully,

G.C.Swan

City Engineer.

Table V.

Sec.3.

IRRIGATED ACREAGE,?UTAH LAKE VALLEY, PROVO RIVER AND SPRING CREEK.

Compiled from surveys and data as shown by letters herewith.

<u>Provo Bench Canal & Irrigation Co.Including North Union</u>		
<u>Irrigation Company</u>	4333.00	Acres.
<u>Timpanogus Canal Company</u>	847.00	"
<u>Upper East Union Canal Co.</u>	762.	"
<u>Faucett Field</u>	109.	"
<u>River Bottoms</u>	516.	"
<u>Dry Creek</u>	506.	"
<u>Fort Field</u>	574.	"
<u>Lake Bottoms</u>	1275.	"
<u>Spring Creek</u>	276.	"
<u>West Union,Smith and Carter ditches</u>	1900.	"
<u>Provo City Acreage</u>	1992.	"
<u>Provo666ity Lots</u>	1789.	an
<u>area of, including streets</u>	1200.	"
<u>Total</u>	14,290.	"

Note:

For the Purposes of this report,the above noted acreage will be used.

The present irrigated acreage under the Provo Bench Canal & Irrigation Company,and the Timpanogus Canal Company,was compiled ~~by~~ jointly by a representative of ~~Each~~ of these companies and a representative of the Provo Reservoir Company,and which amounts ,I believe,are acceptable and satisfactory to both parties.

The Provo City acreage is submitted by Provo City.

The acreage of the other parties,excepting the First Ward Pasture Company, is submitted by The Provo Reservoir Company,on a compilation of a hydro-graphic survey,and until a joint compilation is made,or an acceptable amount determined this data,the result of an actual survey,will be admitted as being correct.

The acreage allowed under the provo City lots,includes streets, buildings, pavements ect.,the amount under this head is a very difficult problem,but the amount ^{of water} ^{hereafter} allowed,in my opinion is fully adequate to cover all uses.

DISTRIBUTION OF PROVO RIVER UNDER " MORSE DECREE "

Table VI

Canal.	15000 m.f.	14999 m.f.	12000 m.f.	11999 m.f.	*Max.	
	Prop. Amt.	Prop. Amt.	Prop. Amt.	Prop. Amt.	Cap'ty	Date.
Lake B.C.Co.	.0545 13.625	.0595 14.875	.0595 11.900	.0633 12.660	27.27	7-2-04
P.B.C.&I.Co.	.2295 57.375	.1765 44.125	.1765 35.300	.1444 28.880	139.88	6-2-13.
Timpanogus.	.0395 9.875	.0355 8.875	.0355 7.100	.0290 5.800	39.65	6-2-13.
U.E.U.&F.F.	.0774 19.350	.0845 21.125	.0845 16.900	.0905 18.100	47.62	6-2-13.
Provo City et.	.3525 88.125	.3895 97.375	.3895 77.900	.4023 80.460	185.34	6-2-13.
L.D.Creek	.0321 8.025	.0390 9.750	.0390 7.800	.0430 8.600	20.17	6-6-05.
River Bot.	.0875 21.875	.0875 21.875	.0875 17.500	.0879 17.580	101.85	6-7-05.
W.Union et al.	.1260 31.500	.1270 31.750	.1270 25.400	.1385 27.700	69.88	6.20-04.
M.Tanner	.0010 .250	.0010 .250	.0010 .200	.0011 .220	No Record.	
Totals	1.0000 250.00	1.0000 250.0	1.0000 200.0	1.0000 200.0	667.28	6-2-13.

* Maximum measured flow, and date. Note;— Amounts are given in second feet.

DISTRIBUTION OF PROVO RIVER UNDER " CHIDESTER DECREE "

Canal.	Class "A" (17467 M.F.).	Class "B".	Class "B". after deducting "A"
	16931*		
Provo City et al---	17000		17000/17960=95%
Hyrum Heilset-----	9.		
Springdell R.CO.-----	60.		
George Duke -----	30.		
J.Mecham -----	20.		
Ed Mecham -----	40.		
C.S.Conrad-----	50.	24.	
J.R.Hooks-----	30.		
J.H.Snider-----	40.		
S.Fork Cattle Co. ----	4.	18.	
George Taylor-----	8.	8.	
J.W.Hoover-----	114.		
Wright Estate-----	60.		
Blue Cliff-----	69		960/17960 = 5%
Total	17465.	" 50. A"	

reserves

Sec.7. The Telluride Power Co. ~~has~~ right to use of such water ~~as~~ as it may require for domestic purposes, from the springs arising in Lot 3, sec.33, tp. 5 S. Range 3 East.

Also; The telluride Power Co. has the right to use for domestic and irrigation purposes, at such place as it may elect, all of the water of "Johnson's Springs" (These two paragraphs refer to the ~~same~~ same water)

DISTRIBUTION OF PROVO RIVER UNDER " MORSE DECREE " BY PROPORTION.

	15000 m.f. and up.	15000 to 12000.	12000 and below.
Lake B.C.Co.-----	.0545	.0595	.0633
P.B.C.&I.Co.-----	.2295	.1765	.1444
Timpanogus-----	.0395	.0355	.0290
U.E.U.&F.F.-----	.0774	.0845	.0905
Provo City et al-----	.3525	.3895	.4023
L.D.Creel -----	.0321	.0390	.0430
River Bottoms-----	.0875	.0875	.0879
W.Union et al -----	.1260	.1270	.1385
M.Tanner -----	.0010	.0010	.0011
Totals	1.0000	1.0000	1.0000

TABLE SHOWING DISTRIBUTION AND WATER DUTY UNDER THE "MORSE DECREE".

Canal System.	Irrig Area.	At 300 sf. Stage Prop.	Quant	Stage Duty.	At 250 sf. Stage Prop	Amt.	Stage Duty	At 250- sf. stage Prop	Amt.	stage Duty
Provo Bench Canal & I.Co	4333	.2295	68.85	<u>63</u>	.2295	57.37	<u>76</u>	.1765	44.12	<u>98</u>
Timpanogus Canal Co.	847	.0395	11.85	<u>72</u>	.0395	9.87	<u>86</u>	.0355	8.87	<u>105</u>
Upper East Union	762	.0605	18.15	<u>42</u>	.0605	15.12	<u>50</u>	.0665	16.62	<u>46</u>
Faucett Field	109	.0169	5.07	<u>21</u>	.0169	4.22	<u>26</u>	.0180	4.50	<u>24</u>
River Bottoms	516	.0875	26.25	<u>20</u>	.0875	21.87	<u>23</u>	.0875	21.87	<u>24</u>
Little Dry Creek	506	.0321	9.63	<u>53</u>	.0321	8.02	<u>63</u>	.0390	9.75	<u>52</u>
Lake Bottoms	1275	.0545	16.35	<u>78</u>	.0545	13.62	<u>94</u>	.0595	14.87	<u>86</u>
West Union Smith, Carter	1900	.1260	37.80	<u>50</u>	.1260	31.50	<u>60</u>	.1270	31.75	<u>60</u>
Provo City	3192	.3525	85.30	<u>37</u>	.3525	67.67	<u>47</u>	.3895	66.82	<u>48</u>

Note: The amount to Provo City as shown is 20.45 less than the proportionate part. 19.3 second feet allowed for machine interests, and 1.15 for Blue Cliff Right.

Table VIII

TABLE SHOWING DUTY OF WATER IN THE UTAH VALLEY WITH CANALS
AT THE MAXIMUM RECORDED CAPACITY.

	Irrig Area.	Max.Rec. Cap.	Duty.
Provo Bench	4333	139.88	31
Canal & Irrig Co.	132x22		
Timpanogus Canal Co.	847.	39.65	21
Upper E.Union &Faucett Fd.	871	47.62	18
River Bottoms	516	101.85	5.
Little Dry Creek	506	20.17	25.
Lake Bottoms	1275	27.27	47
West Union Smith,Carter	1900	69.88	27
Provo City	3192	110.43 (185.34)	29

Note: The total diversion to Provo City was 185.34 sec.ft. 74.91 sec.ft. in the Factory Race, this amount is deducted in the calculation.

" This table is given to show the
inconsistency of claimants for
allotment to full capacity. "

TABLE SHOWING DISTRIBUTION AND WATER DUTY.

For July 28,1914.

Under Stipulation of May 25,1914, and on order of Commissioner
of July 28,1914.

	Irrig Area	Amt.sf.	Duty.
Provo Bench Canal & I.Co.	4333	106.00	<u>41</u>
Timpanogus Canal Co.	847	18.00	<u>47</u>
Upper E.Union & Faucett Fd.	871	23.20	<u>38</u>
River Bottoms	516	26.25	<u>20</u>
Dry Creek	506	10.00	<u>51</u>
West Union Smith Carter	1900	37.80	<u>50</u>
Provo City	3192	98.70	<u>32</u>

Note; The amount to Provo City as shown is 19.30 second-feet less than the amount allotted,19.3 second-feet allowed for machine interests.

Table X

TABLE SHOWING DISTRIBUTION AND WATER DUTY.

August 15-28,1914.

This table is only an approximation, and merely assumes to show the relative duties of water during this period.

	Irrig Area.	Amount Sec.feet	Duty.
Provo Bench Canal & I.CO.	4333	86.75	50
Timpanogus	847	18	47
Upper East Union & Faucett Fd.	871	23.20	38
River Bottoms	516	26.25	20
Dry Creek	506	10.	51
West Union Smith,Carter	1900	37.80	50
Provo City	3192	95.3	33 (Exclusive Machine Water)
Fort Field	574	7.03	81
Lower Charleston	500	21	24
Spring Creek & Sagebrush	1200	21.37	56
Upper Charleston	653	20.47	32 (6 s.f. added for inflow)
Midway Irrig.Co.	4109	47.21	87
Wasatch Canal Co.60(Reported by John Clegg)		

The duty to Wasatch Canal Co. does not include storage water.
The amount to Provo City as shown is 19.3 sec.ft. less than the amount allotted, 19.3 sec.ft. is allowed for machine interests.

TABLE SHOWING EVAPORATION LOSSES. FROM FREE WATER SURFACES.

Mean evaporation of Utah Lake, from record of Louis C. Kelsey, City Engineer Salt Lake City, published in Fifth biennial Report of Utah State Engineer, page 305.

April	May	June	July	August	Sept.	
.386	.547	.733	.784	.631	.564	Total for six months 3.645 feet,

which equals 44 inches (Approx.)

Mean evaporation for three localities in Idaho, as shown by Book 1. (Ninth biennial Report of the State Engineer Of Idaho) page 297, shows an average loss for April to September, inclusive, Of 1.53 inches per week, or a total loss of ~~32x~~ 40. inches.

EVAPORATION FROM IRRIGATED SOILS.

Compiled from Bulletin No. 248, U.S. Dept. Agriculture. Office of Exp. Stations.

Deductions from tables on page 12:

1. Experiments were made at Davis, California, June, - July 1908. period 21 days.
2. Maximum temperature during time 88° F. (Mean)
3. Mean Minimum temperature 49.7° F.
4. Total loss of water from free surface for the 21 day period 8.27 inches.
5. the loss of water from unmulched surface 1.35 inch, which was equal to 22.6 per cent of total amount applied in irrigation, and which loss equaled 1.08 per cent daily average.
6. The loss on a three inch mulched surface, equaled 5.2 per cent of water applied by irrigation, or .25 per cent daily average.

Deductions from Tables on page 14:-

1. Experiments were made at Davis, Cal., Sept. 1, to Oct. 3, 1908. period 32 days.
2. Mean Maximum temperature during period 85.3° F.
3. Mean Minimum temperature during period 50.9° F.
4. Total loss of water from free surface for period 10.19 inches.
5. Loss of water from unmulched surface 2.15 inches, or 35.9 per cent of total applied by irrigation, a daily average loss of 1.12 per cent of water applied.
6. The loss from a 3 inch mulched surface was 0.91 inch, or 15.2 per cent of water applied, or 0.48 per cent daily average loss.

Deductions from tables on page 16:-

1. Experiment were made at Reno, Nev., June 9-30, and Sept 1-22, tables show a average of of the two periods.
 2. Loss from free water surface 4.68 inches.
 3. Loss from unmulched surface 1.41 inch, or 23.6 per cent of total water applied by irrigation, or a daily average loss of 1.14 per cent.
 4. Loss from 3 inch mulched surface 0.88 inch, or 14.6 per cent of total water applied, a daily average loss of .7 per cent.
- Note Total water applied 6 inches.

Deduction from tables on page 29:-

An average of experiments shown in the table shows:-

1. Evaporation from unmulched surface is 28.15 per cent for a period of 21 days, an average daily loss of 1.34 per cent of water applied.
2. Evaporation from a 3 inch mulched surface for a period of 21 days is 13.4 per cent loss, or an average daily loss of .64 per cent of water applied.

Deductions from tables on page 48:-

This table shows a summary of experiments, and is therefore an approximate average of general conditions.

1. Loss from free water surface is 9.71 inches for a period of 28 days, or an average loss daily of .35 inch.
2. Loss from cultivated surface 1.58, for a period of 28 days, an average daily loss 0.056 inch, an average loss of 26.5 per cent of total applied an average daily loss of 0.95 per cent of total water applied.
3. Loss from uncultivated surface is 2.13 inches, for a period of 28 days, an average daily loss of 0.076 inch, and average loss of 35.6 per cent of total water applied, an average daily loss of 1.57 per cent of water applied.
4. Cultivation reduces evaporation approximately 25 per cent.
5. Mean Temperature under these experiments was 66.3 F.

Note. Mean normal temperature for Provo for the month of June is 64.8° F. for July is 73.3° F. for August is 71.1, for Sept. 70.9, for May 57.4, an average mean normal for May, June, July, August and Sept. of 67.5° F.

CONCLUSIONS:- For all practical purposes average daily loss of water from uncultivated soils is 1.5 per cent, daily average, of water applied.

For all practical purposes average daily loss of water from by evaporation from Cultivated soils is 1. per cent, of water applied.

Sec.5.

TRANSMISSION LOSSES.

No.1. July,23,1914.

Lateral No.1,Provo Bench Canal & Irrigation Co.

Flow of system was at the approximate two-thirds stage.

100 feet below head,discharge 11.3. second-feet.

2 $\frac{1}{2}$ miles below head RayPartridge house,discharge 8.66 sec.ft.

Diverted at Jos.Richmond,1.34 sec.ft.

Diverted at John Jones, 0.27 sec. ft.(ByDemming)

Loss in transmission 1.04 second-feet.

Loss per mile 0.42 sec.ft.

Loss per cent per mile 3.6

Soil,gravellyloam with porous subsoil.

Condition of lateral,fair.

No.2. July 29,1914.

North Union Canal.

Flow of system at approx two-thirds stage.

At survey station 5. discharge 31.79 second-feet.

At Station 103,discharge 29.96 " "

Loss----- 1.83 " "

Distance 98 Stations,1.85 miles.

Loss per cent 3.7

Loss per cent per mile 2.

Soil,gravellyloam,with porous subsoil.

Condition of channel,bad, -- not a uniform grade,poor alingment,
large growth of moss.

No.3 July 29,1914.

North Union Canal.

Flow at approximate two-thirds stage.

Station 103 plus,below lateral No.1.Discharge 26.09 second feet.

Station 127 lateral No.2 diverts ----- 4.08 sec.ft.

July 30,same stage by gaging points.

Lateral No.3 Diverts ----- 0.00 " "

" " 4. " ----- 0.00 " "

Station 154 lateral No5. Diverts----- 7.63 " "

" 158 " " 6. " ----- 3.70 " "

Station 161 Main Canal,Discharge ----- 9.75 " "

Total ----- 26.09 25.16

Loss ----- 0.93 s.f

Distance 58 station,1.1 miles.

Loss per cent. 3.6

Loss per cdnt on whole distance,per mile,3.3

Soil on first two-thirds distance is a gravelly loam,with porous
sub-soil,and soil on the last third of distance is a clay loam,and
at station 161 is a clayloam with an impervious claysubsoil.

Sec. 5.

TRANSMISSION LOSSES.

(2)

No.4. July 30,1914.
North Union Canal
Flow as stated heretofore.

Station 161,discharge 9.75 secon-feet.
Lateral No.7 diverts ----- 0.00 sec.ft.

Lateral No.8.at stat.187 diverts 2.24 sec.feet.
" " 9 " " 0.00 " " "
" " 10 " " 210 " ~~3.22~~ "3.50 sec.ft.
At Station 210 inflow of 0.10 sec ft.
Main Channel at station 210 3.99 sec.ft.
Total initial discharge 9.85 sec.feet.
Total available discharge 9.73 " "
Loss----- 0.12 " " .

Loss a negligable quantity,
Soil is a clay loam,with a stiff ~~clay~~ light colored subsoil.

No5. August 8,1914.
Lower Charleston Canal.

From a point near the head to the center of Charleston Town,near the home of Bishop Ritchie, there is no difference in flow,there is no loss,or inflow and loss balance.

No.6. Provo City,irrigation system.
Sept 28,1914.
Ditch on West side 9th west street.

150 feet South of Center street.
Depth on 1 ft. Cipp.Weir 5 inches,discharge 0.916 sec.ft.

75 Feet North of 6th South Street.
Depth on 1 ft. Cipp. weir 4 3/4 inches, discharge 0.852 sec.ft.

Difference 0.064 sec.ft.
Distance 0.48 mile.
Loss per mile ~~1.33~~ .133 sec.ft.
Loss per cent per mile 15.

No.7. Provo City Irrigation Syatem.
Sept 29,1914.
Ditch on East side of 1st East street.

50 Feet South of 8th North Street.
Depth on 1ft. Cipp. weir 3 1/4 inches,discharge 0.472 sec.ft.

100 Feet North of 1st South Street.
Depth on 1 ft. Cipp.weir. 3 1/16 inches,discharge 0.430 sec.ft.

Difference 0.042 sec.ft.
Distance 0.78 mile.
Loss per mile 0.054 sec.ft.
Loss per cent per mile 11.

Sec.5. TRANSMISSION LOSSES.

(3)

No.8. Provo City Irrigation System.

Sept.29,1914.

Ditch on ~~East~~ West side of 1st East Street, at 8th North, along South side of ~~1~~ 7th North street to the West side of Academy Avenue, and South along the West side of Academy Avenue.

60 Feet South of 8th North Street,

Depth on 1ft.Cipp.weir 5 inches, discharge 0.916 sec.ft.

Academy Avenue and 2nd North Street.

Depth on 1 ft. Cipp. weir 4 13/16 inches, discharge 0.867 sec.ft.

Difference 0.049 sec.ft.

Distance 0.62 mile.

Loss per mile 0.079 sec.ft.

Loss per cent per mile 8.6

No.9. Provo City Irrigation System.

Sept.29,1914.

Ditch on East side of 3rd East Street.

80 Feet South of 8th North.

Depth on 1 ft. Cipp. weir 3 3/4 inches. Discharge 0.58 sec.ft.

40 Feet South of Center Street.

Depth on 1 ft. Cipp. weir 3 1/8 inches. Discharge 0.53 sec.ft.

Difference 0.05 sec.ft.

Distance 0.73 mile.

Loss per mile 0.068 sec.ft.

Loss per cent per mile 12.

Explanatory; In each and every case in these measurements, extreme care was taken to obtain precise results, fine point gage hubs were set and observed to determine if there ~~was~~ occurred any difference of flow at either the head or tail station, and no change of flow during time of observation occurred.

The 1 foot Cipp. Weir used, is of steel, of good construction, and perfect lines, furnished by Provo City.

Where weir is not specified, meter No.1350 was used, on rating of April 2, 1914, by the Rensselaer Polytechnic Institute Hydraulic Laboratory. Watch "New York Standard No. 5509953".

TABLE SHOWING COST PRODUCTION OF DIFFERENT CROPS IN UTAH VALLEY, UTAH.

Items	Crop (Cost per acre)			
	Sugar Beets	Alfalfa	Wheat	Potatoes.
Flowing -----	\$3.50		\$3.00	\$3.50
Disking and harrowing -----	1.00	\$2.00	1.00	1.00
Leveling -----	.50			
Seeding -----	2.75		1.00	2.00
Seed -----			1.80	5.00
Ditch repairs -----	.50	.50	.50	.50
Furrowing out and cultivating -----	2.40		.50	4.00
Cutting and Shocking -----			2.00	
Cutting and raking -----		1.25		
Hauling -----		4.00	2.00	
Threshing -----			4.00	
Harvesting -----	19.50			12.00
Thinning -----	5.00			
Hoeing -----	2.00			2.00
Irrigating -----	2.00	5.00	1.00	3.00
Fertilizer -----	10.00		10.00	10.00
Wear and tear on farm equipment	1.00	1.00	1.00	1.00
Interest on investment (Land and water valued at \$250.per acre)at 8% -----	20.00	20.00	20.00	20.00
Interest on investment in farm equipment -----	2.00	2.00	2.00	2.00
Totals -----	\$72.15	\$35.75	\$49.30	\$66.00
Average market price per bushel -----			.80	4.0
Average market price per ton -----	5.00	10.00		
Number of bushels yield necessary to cover cost of production -----			62.00	165.00
Number of tons yield necessary to cover cost of production -----	14.4	3.6		

TABLE SHOWING YIELD OF CROPS WITH DIFFERENT QUANTITIES OF APPLIED WATER.
(Yields diminished by excess of water are omitted.)

Crop	Inches of applied water.										
	5.00	7.50	10.00	15.00	20.00	25.00	30.00	35.00	40.00	45.00	50.00 60.00
Wheat	37.81	41.54	43.53	45.71		46.46		48.55			<u>49.38</u> bu.
Straw	2986	3301	3452	3954		4311		4755			<u>5332</u> lbs.
Oats	62.28		54.76	71.54	<u>80.70</u>				79.06		Bu.
Straw	2092		2269	2617	<u>3031</u>				<u>3611</u>		lbs.
Barley		<u>68.76</u>		67.66		66.15					
Straw		<u>3946</u>		4437		4477		62.59*			bu.
								<u>5929*</u>			lbs.
Corn		79.14	89.52	93.93	91.58	<u>99.16</u>	97.12				
Stover		7189	6007	8279	8692	<u>9492</u>	10390				96.78(55 in.) bu.
											10258 " " lbs
Timothy		3982		3844			6054				<u>8406</u> lbs.
Orchard Grass			2829	2685					4042		<u>5270</u> lbs.
		2526									
Bromus Enern.	4480	<u>4957</u>	3821					4757			lbs.
Rye Grass.	2327		2218								<u>3201</u> lbs.
Alfalfa		9884	7546	9097	9354	8840				<u>10813</u>	lbs.
Su.Beets	13.78	18.63	19.45	21.28		20.82				<u>24.54</u>	tons.
Carrots	34577	33223	49507		46755		56930				<u>68420</u> lbs.
Potatoes	154. 182. 195.0		227. 267.			244.		253.		<u>304.</u>	bu.
Onions			21471	22038		32437					20x11 (65) <u>34171</u> #
Cabbage	18490(12.5)			18524	16310		20432			(70)	<u>23098</u> #

* Approximate.

Highest production is underscored.

Note:-

This sheet is a compilation of "Utah Agricultural College Experiment
Station Bulletin No. 117" (Conventional mark 3)

Table XIV.

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TABLE SHOWING DEPTH PER ACRE PER DAY OF WATER DUTY

Duty	Depth.	Duty	Depth.	Duty	Depth.	Duty	Depth
1.	1.98347	50.	.03967	100.	.01983	150.	.01322
2.	.99174	51.	.03889	1.	.01964	1.	.01314
3.	.66116	52.	.03814	2.	.01945	2.	.01305
4.	.49587	53.	.03742	3.	.01926	3.	.01296
5.	.39669	54.	.03673	4.	.01907	4.	.01288
6.	.33058	55.	.03606	5.	.01889	5.	.01280
7.	.28335	56.	.03542	6.	.01871	6.	.01271
8.	.24793	57.	.03480	7.	.01858	7.	.01263
9.	.22039	58.	.03420	8.	.01837	8.	.01255
10.	.19835	59.	.03362	9.	.01820	9.	.01248
11.	.18032	60.	.03306	110.	.01803	160.	.01240
12.	.16529	61.	.03252	1.	.01787	1.	.01232
13.	.15257	62.	.03199	2.	.01771	2.	.01224
14.	.14168	63.	.03148	3.	.01755	3.	.01217
15.	.13223	64.	.03099	4.	.01740	4.	.01209
16.	.12397	65.	.03052	5.	.01726	5.	.01203
17.	.11667	66.	.03005	6.	.01710	6.	.01195
18.	.11019	67.	.02960	7.	.01695	7.	.01188
19.	.10439	68.	.02917	8.	.01681	8.	.01181
20.	.09917	69.	.02875	9.	.01667	9.	.01174
21.	.09445	70.	.02834	120.	.01653	170.	.01167
22.	.09016	71.	.02794	1.	.01639	1.	.01160
23.	.08624	72.	.02755	2.	.01625	2.	.01153
24.	.08265	73.	.02717	3.	.01613	3.	.01147
25.	.07934	74.	.02680	4.	.01600	4.	.01140
26.	.07629	75.	.02645	5.	.01587	5.	.01133
27.	.07346	76.	.02610	6.	.01574	6.	.01127
28.	.07084	77.	.02576	7.	.01565	7.	.01121
29.	.06840	78.	.02543	8.	.01550	8.	.01114
30.	.06612	79.	.02511	9.	.01538	9.	.01108
31.	.06398	80.	.02479	130.	.01526	180.	.01102
32.	.06255	81.	.02449	1.	.01514	1.	.01096
33.	.06011	82.	.02419	2.	.01503	2.	.01090
34.	.05834	83.	.02390	3.	.01491	3.	.01084
35.	.05667	84.	.02361	4.	.01480	4.	.01078
36.	.05510	85.	.02334	5.	.01470	5.	.01072
37.	.05361	86.	.02306	6.	.01459	6.	.01066
38.	.05220	87.	.02280	7.	.01448	7.	.01061
39.	.05086	88.	.02254	8.	.01437	8.	.01055
40.	.04959	89.	.02229	9.	.01427	9.	.01050
41.	.04838	90.	.02204	140.	.01417	190.	.01044
42.	.04723	91.	.02180	1.	.01407	1.	.01039
43.	.04613	92.	.02156	2.	.01397	2.	.01033
44.	.04508	93.	.02133	3.	.01387	3.	.01028
45.	.04408	94.	.02110	4.	.01377	4.	.01022
46.	.04312	95.	.02088	5.	.01368	5.	.01017
47.	.04220	96.	.02066	6.	.01359	6.	.01012
48.	.04132	97.	.02045	7.	.01349	7.	.01007
49.	.04048	98.	.02024	8.	.01340	8.	.01002
50.	.03967	99.	.02004	9.	.01331	9.	.00997
		100.	.01983	150.	.01322	200.	.00992

EXISTING DECREES.

It is, indeed, a question at this time, to explain, or account for, the basis or conditions, upon which the "Morse" and "Chidester" decrees were made. Was it an exaggeration of areas irrigated, or was it based on biased or unqualified testimony on the quantity of water necessary, or was it based on a small river without consideration of data that might have been admitted as testimony? It is reasonable to suppose that all the factors played a prominent part.

By Table VI the "Chidester" decree gives to the canyon rights as class "A" a second-foot for 60 acres, and some no xx participation in the class "B" water. It does not define to the plaintiffs a definite quantity ~~in second-feet~~, but decrees the remaining whole of Provo River, without regard to necessities..

On this allotment and using the "Morse" decree proportions, when the Provo River on June 7, 1909, was flowing 3,660 second-feet, the Provo City Water right was nearly 1,300 second feet about eight times their highest recorded carrying capacity, the Provo Bench water right was more than 800 second-feet, about six times their maximum recorded carrying capacity, the West Union and Smith Ditch, more than 400 second feet, about six times their recorded maximum carrying capacity. It is useless to cite more of these cases, or to admit argument that any such title is valid, or to be able to deduct from this decree any rights quieted except the amounts specifically stated.

Turning now to Table VII., and noting the column of water duty under the 300 second-foot stage, "Morse Decree", and also noting by Plate III that the average mean low water approximates 300 second feet, the decree awarded to the Provo Bench a second-foot for 63 acres, the Timpanogus a second-foot for 72 acres, Upper East Union a second-foot for 42 acres, Faucett Field a second-foot for 21 acres, River Bottoms a second-foot for 20 acres, Dry Creek a second-foot for 53 acres, Lake Bottoms a second-foot for 78 acres, West Union and Smith Ditch et al a second-foot for 50 acres, and Provo City a second-foot for 37 acres, extremes of a 78 acre duty and a 20 acre duty.

Sec. 7.

The River Bottoms drawing a 20 acre duty, to the 72 acre duty of the Timpanogus, the former more than three and one-half times greater than the latter, The River Bottoms for 100 days a depth of 9.92 feet per acre, the Timpanogus a depth of 2.75 feet per acre.

Note also the duties under the first column of the 250 second-foot stage, ranging from 23 acres per second-foot to 94 acres per second-foot.

And Note also the last column the 250 second-foot stage, duties ranging from 24 acres per second-foot to 105 acres per second-foot, ~~more than~~ a greater difference than 4 to 1.

By Table VIII., note the duty of water compared to capacity of canals, this is considered by some as a factor of right and title, A duty as low as a second-foot for 5 acres, .4 of an acre foot per day per acre, enough to cover all the land 12 feet deep per month. Which of these titles is equitable?

At this point, please bear in mind, that, in this discussion, I intend not, to cast reflections on the Court, I have stated before the probable causes that have brought about these conditions, the Court was evidently aware of this and inserted paragraph XV ("Morse Decree") which reads as follows; " That all the rights, fixed, declared and decreed herein, are founded upon appropriation of water, necessary for some beneficial uses, and that all such rights, hereby fixed, declared and decreed are subject in their exercise, to the conditions that they are required and necessary for some beneficial use, and that all such rights are expressly subject to the limitations and conditions that such waters are used for some beneficial purpose, and are used economically without waste, and with due care, and are reasonably and fairly necessary for such use,*****.

Then all above this amount, so specifically stated, is subject to appropriation.

Later, in 1910, the Plaintiff in this action, came as a new appropriator, basing its project, on a small storage supply, the unappropriated flood waters, and the amount of natural flow not "used economically" and "without waste".

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After four years of "brotherly conferences", "Proffered stipulations" and "get together squabbles", the parties with their attorneys, appeared before the Court in the Spring of 1914, to agree on a working basis for the season. They finally submitted to the Court for signature, on May 25, 1914, a stipulation, it bears the earmarks of "An attorneys first experience with irrigation, and a farmers first experience with court."

However it was intended to bring peace and a solution of all existing evils. Let us see the affects, turn to Table IX, and note the duties: 42, 47, 38, 20, 51, 50, and 32, .

Then turn to Table X and note the duties: 50, 47, 38, 20, and 27.

In all these decrees and stipulations, were the facts at hand: Equity, and right, and ~~x~~ the statute provisions, were entirely unconsidered.

"These evils have long been recognized by practical irrigators and by lawyers and judges".

" In a brief before the State supreme Court (Colorado), Judge Elliot, an ex-justice of that court, thus forcibly describes them:"

"Excess priority decrees are a crying evil in the State. From every quarter the demand for their correction is strong and loud. Such crying demand cannot be silenced by declaring that the meaning and effect of such decrees can never be enquired into, construed or corrected after four years.

In many cases such decrees are so uncertain, so ambiguous, so inequitable, so unjust, and their continuance is such a hardship, that litigated cases will be continually pressed upon the attention of the courts until such controversies are heard and settled, and settled right. Litigation in a free country can never end while wrongs are unrighted".

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" Another distinguished irrigation authority, Mr. Pratt Rogers of Denver, has added his testimony in the same direction:- "

" The decrees, in their entirety, are falsehoods and universally accepted as such. They furnish a fresh illustration of the truism that ' a lie never ceases to do evil'. If the construction heretofore placed upon them in some cases is to prevail, we have legalized a method of accomplishing the precise thing the Constitution intended to prevent, viz., speculation in water."

In the report of Commission appointed to revise Water Laws of Colorado, in speaking of the results of adjudications clearly summarized their defects as follows:-

" It (has) resulted that the amount of water to which the several appropriators of the works of diversion were entitled was ascertained and determined in these decrees by the interested conjecture of those proprietors; that almost invariably the amount awarded largely ~~ex~~ exceeded** sometimes threefold-- the carrying capacity of the ditch, ~~and the xxxxxxxx volume of the stream was absolutely judged to be the xxxxxxxx of the xxxxxxxx~~ *****.

The decrees, therefore, instead of affording, as was intended, a just, true, and absolute measure of the rights of ~~the~~ all appropriators for irrigation, are in fact, false, and misleading, even as to those who participated in the enquiry upon which they are founded, and absolutely void as to all others."

The Hon. A.J. McCune an ex state Engineer of Colorado states in a report along this line as follows:-

" It appears to us that the most serious question connected with irrigation is the unstable condition of our water rights. In many instances, as the communities depending on irrigation grow older, complications seem to increase rather than ~~diminish~~ decrease Many of our troubles have arisen from carelessness in issuing decrees and by overappropriation, the present method being a kind of grab game without the necessary public supervision."

To the parties to this action, Plaintiff and defendants, I say, do not continue this practice of inequitable distribution, "get to-gether" and first, acknowledge, that, the existing decrees are neither equitable; just, nor practical, and second, ~~they~~ agree on a tentative duty for each system for a season, when you find defects meet and make corrections, and you will be able to make a fair and proper solution of this problem.

The writer hereafter gives a duty and a quantity for each system, that may be acceptable with few exceptions. Consider it fairly, and where you find necessary revise.

This suggestive duty is given to help you, and points out the only road to successful adjudication, that will stand against continuous litigation, and expense.

WATER RIGHTS.

Water rights originally began, on the Provo, with the beginning of irrigation, in the early settlement of this State.

The Constitution of the State Of Deseret made no mention of water rights, but the legislature made grants to the use of water.

In 1851 Congress created the Territorial Government of Utah, but made no provisions for the use of the waters of the territory, but the legislature continued to assume the right to dispose of water. It also passed a law delegating this power to the County Courts of the several counties. Organization of ^{the} North Union Irrigation Company ^{District} and to the Provo Bench Canal Company ^{Districts} are examples of record under this system.

A new irrigation law was passed in 1880, which provided a system of supervision, ^{By the County Court for} hearing of disputes, settling of titles, and the recording of rights. It also defined the Primary and Secondary rights. All of the provisions of this law were never fully enforced.

" One principle of this law has lived, however, and been reenacted and its principle extended in court decisions. This is the definition of primary and secondary rights."

" Primary rights include all rights acquired up to the time when the sum of the rights equals the average flow of the stream at low water stage. Secondary rights are acquired to any supply in excess of the average low water flow, and are subject to the complete enjoyment of the primary rights. Whenever there is not enough for all the primary rights, the flow of the stream is divided among them pro rata. When there is more than enough for the primary rights, but not enough for all the secondary rights, the excess over the primary rights is divided among the secondary rights pro rata."

No further irrigation legislation was enacted until 1897. Utah Became a state in 1896 and the Constitution

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adopted Article XVII (Existing Right Confirmed) "All existing rights to the use of ~~water~~ any of the waters in this State for any useful or beneficial purpose, are hereby recognized and confirmed."

By the revised Statutes of 1898 section 1265, and by our present statute section 1288x27 the law of Priority Among Appropriators is defined as follows:-

"Appropriators shall have priority among themselves according to the dates of their respective appropriations, so that each appropriator shall be entitled to receive the whole supply to which his certificate entitles him before any subsequent appropriator shall have any right; provided, that whenever the natural flow of any stream shall have receded in volume in the annual low water stage, then the rights of all users to such flow at such stage shall be deemed to be equal as to priority, and the water, when at or below such stage, shall be apportioned pro rata among said users. But in times of scarcity, while priority of appropriation shall give the better rights as between those using water for the same purpose, the use for domestic purposes shall have preference over use for all other purposes, and ~~the~~ use for agricultural purposes shall have preference over use for ^{any} ~~all~~ other purpose except domestic use.

And to the quantity of water an appropriator is entitled note; ~~in XIXx1x2x3x4x5x6x7x8x9x10x11x12x13x14x15x16x17x18x19x20x21x22x23x24x25x26x27x28x29x30x31x32x33x34x35x36x37x38x39x40x41x42x43x44x45x46x47x48x49x50x51x52x53x54x55x56x57x58x59x60x61x62x63x64x65x66x67x68x69x70x71x72x73x74x75x76x77x78x79x80x81x82x83x84x85x86x87x88x89x90x91x92x93x94x95x96x97x98x99x100x101x102x103x104x105x106x107x108x109x110x111x112x113x114x115x116x117x118x119x120x121x122x123x124x125x126x127x128x129x130x131x132x133x134x135x136x137x138x139x140x141x142x143x144x145x146x147x148x149x150x151x152x153x154x155x156x157x158x159x160x161x162x163x164x165x166x167x168x169x170x171x172x173x174x175x176x177x178x179x180x181x182x183x184x185x186x187x188x189x190x191x192x193x194x195x196x197x198x199x200x201x202x203x204x205x206x207x208x209x210x211x212x213x214x215x216x217x218x219x220x221x222x223x224x225x226x227x228x229x230x231x232x233x234x235x236x237x238x239x240x241x242x243x244x245x246x247x248x249x250x251x252x253x254x255x256x257x258x259x260x261x262x263x264x265x266x267x268x269x270x271x272x273x274x275x276x277x278x279x280x281x282x283x284x285x286x287x288x289x290x291x292x293x294x295x296x297x298x299x300x301x302x303x304x305x306x307x308x309x310x311x312x313x314x315x316x317x318x319x320x321x322x323x324x325x326x327x328x329x330x331x332x333x334x335x336x337x338x339x340x341x342x343x344x345x346x347x348x349x350x351x352x353x354x355x356x357x358x359x360x361x362x363x364x365x366x367x368x369x370x371x372x373x374x375x376x377x378x379x380x381x382x383x384x385x386x387x388x389x390x391x392x393x394x395x396x397x398x399x400x401x402x403x404x405x406x407x408x409x410x411x412x413x414x415x416x417x418x419x420x421x422x423x424x425x426x427x428x429x430x431x432x433x434x435x436x437x438x439x440x441x442x443x444x445x446x447x448x449x450x451x452x453x454x455x456x457x458x459x460x461x462x463x464x465x466x467x468x469x470x471x472x473x474x475x476x477x478x479x480x481x482x483x484x485x486x487x488x489x490x491x492x493x494x495x496x497x498x499x500x501x502x503x504x505x506x507x508x509x510x511x512x513x514x515x516x517x518x519x520x521x522x523x524x525x526x527x528x529x530x531x532x533x534x535x536x537x538x539x540x541x542x543x544x545x546x547x548x549x550x551x552x553x554x555x556x557x558x559x560x561x562x563x564x565x566x567x568x569x570x571x572x573x574x575x576x577x578x579x580x581x582x583x584x585x586x587x588x589x590x591x592x593x594x595x596x597x598x599x600x601x602x603x604x605x606x607x608x609x610x611x612x613x614x615x616x617x618x619x620x621x622x623x624x625x626x627x628x629x630x631x632x633x634x635x636x637x638x639x640x641x642x643x644x645x646x647x648x649x650x651x652x653x654x655x656x657x658x659x660x661x662x663x664x665x666x667x668x669x670x671x672x673x674x675x676x677x678x679x680x681x682x683x684x685x686x687x688x689x690x691x692x693x694x695x696x697x698x699x700x701x702x703x704x705x706x707x708x709x710x711x712x713x714x715x716x717x718x719x720x721x722x723x724x725x726x727x728x729x730x731x732x733x734x735x736x737x738x739x740x741x742x743x744x745x746x747x748x749x750x751x752x753x754x755x756x757x758x759x760x761x762x763x764x765x766x767x768x769x770x771x772x773x774x775x776x777x778x779x780x781x782x783x784x785x786x787x788x789x790x791x792x793x794x795x796x797x798x799x800x801x802x803x804x805x806x807x808x809x810x811x812x813x814x815x816x817x818x819x820x821x822x823x824x825x826x827x828x829x830x831x832x833x834x835x836x837x838x839x840x841x842x843x844x845x846x847x848x849x850x851x852x853x854x855x856x857x858x859x860x861x862x863x864x865x866x867x868x869x870x871x872x873x874x875x876x877x878x879x880x881x882x883x884x885x886x887x888x889x890x891x892x893x894x895x896x897x898x899x900x901x902x903x904x905x906x907x908x909x910x911x912x913x914x915x916x917x918x919x920x921x922x923x924x925x926x927x928x929x930x931x932x933x934x935x936x937x938x939x940x941x942x943x944x945x946x947x948x949x950x951x952x953x954x955x956x957x958x959x960x961x962x963x964x965x966x967x968x969x970x971x972x973x974x975x976x977x978x979x980x981x982x983x984x985x986x987x988x989x990x991x992x993x994x995x996x997x998x999x1000~~ footnote 1288x5 R.S. 1907.

"Only entitled to what he needs Though one appropriates a specific quantity of water for a specific purpose, he is entitled to such quantity only as will satisfy the purpose for which the appropriation was made."

"Reasonable necessity and reasonable use. An appropriator of water is not confined to an appropriation simply for the amount of land irrigated during the first year of his diversion. The extent of an appropriation of water is determined by the reasonable necessity for the use of the water, by the intention of the appropriator, followed by reasonable diligence

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in executing such intent, and by the beneficial purpose for which the appropriation is made."

"Appropriation and use. The right of a prior appropriator is fixed by the extent of his appropriation for a beneficial use, and others may subsequently appropriate any water of the stream not so used by a prior appropriator. The right of the former being thus fixed, he cannot enlarge his rights to the detriment of the latter."

And also note 1288x20 R.S. 1907.

"Beneficial use. Beneficial use shall be the basis, the measure, and the limit of all rights to the use of water in this State.

The State Engineer clearly summarizes the necessity of a definition of water rights, in his report of 1902 and 1903, page 15, from which I insert the following;

" The definition of existing rights appears to be of first importance. This is not only necessary to pacify present ~~contention~~ contention, but to prevent future conflicts and encourage further progress. There can be no safe basis for future work before existing rights are known and made of public record. All future works and rights on existing systems must be based on the remnant of unappropriated water of these systems. The extent of this remnant can not be ascertained before the measure of unappropriated water is known, and the sum of the existing rights is the measure of the appropriated water, it is evident that the extent of the remnant can not be known before the existing rights have first been determined.

To defer the definition of these rights is not only to prolong the present general conflict, but to extend the cause of contention by permitting the number of uncertain rights to increase. In the meantime all plans of betterment must of necessity be based on no better foundation than that of the uncertain rights, and be liable to the same disturbances, litigation, and loss that involve all present undefined rights."

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The State Engineer of the State of Idaho in the Ninth Biennial Report adds his testimony along this line as follows;

"Plainly the intent of the law is that an appropriator shall receive a decree for the right to use such an amount of water as he needs and has actually used and no more. This is the plain intent of the law without question. The actual results, however, are far otherwise. Frequently it happens that the parties in the adjudication suit will stipulate into the record a duty of water far in excess of the actual needs of the land, and all parties will receive a decree based upon this artificial and excessive duty of water. In some notorious instances evidence has been introduced by all parties making exorbitant claims as to the amount of water needed, such claims as could in no instance be supported by the best authorities relative to the duty of water. The result is that all of the appropriators receive a decree for a quantity of water in excess of their needs, and sufficient to exhaust ~~the~~ the waters of the stream under adjudication."

And in speaking of the legal problems growing out of the use of water the State Engineer writes, which clearly defines our present condition;

"The legal problems growing out of the diversion and use of water for irrigation have been and are still most ~~perplex~~ perplexing. ~~On the one hand the law is so complicated and the facts are so numerous that it is impossible to give a complete and accurate statement of the law and the facts.~~ Owing to practically all lack of precedents, except those furnished by the pueblos of Mexico, they have passed and are still passing through a period of 'cut and try' development, which has naturally resulted in confusion, uncertainty and litigation with each step of progress."

Out of all this labyrinth of court decrees and stipulations, with the law and the Supreme Court rulings, hammering on, "beneficial use as the measure ~~of~~ and limit of right ^{on the Provo} and title, there stands but one case/that has seemed to have perceived the intent, and found and decreed accordingly.

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This case I x cite as particularly worthy of mention: In the adjudication of the Upper Provo River, the Hon. Judge Dusenberry, in the findings of fact and conclusions of law, ~~paragraph 18, finds~~ finds and decrees.

" That a cubic foot of water per second for each sixty acres, is necessary, to properly irrigate the lands irrigated by the plaintiffs."

This section clearly defines the extent and limitations of water rights, and which is so specifically stated in the findings and decree of the Court in a former case known as the "Morse Decree" paragraph XV and which has heretofore been inserted under section 7. And which is so forcibly outlined by our present statute, "beneficial use shall be the basis, the measure, and the limit of all rights in this State."

The main questions before the Court for determination in this case are, first, the extent of beneficial use of the primary rights, second, the average low water stage of the Provo River, and third, the flow of Provo River that is denoted as "times of scarcity".

Hereinafter under section devoted to the duty of water I give an approximate definition of the extent of the primary rights, which is subject to trial until a final determination can be made.

Plate III and Table III give the average low water stage of the Provo River in the Utah Valley, this data and the chronological Table II show the dates this stage covers.

Webster defines scarcity as : Smallness of quantityx to the wants or demands: deficiency: lack of plenty." I interpret the meaning of the statute to be: a deficiency that will cause a material loss or a permanent injury to the agricultural interests if continued over any considerable time. In the Utah Valley, the requirements of crops demand an application of water at times not to exceed fourteen days, and the irrigating season must continue to nearly the first of October, and the last complete irrig-

ATION, cannot be earlier than September 10th, then "a time of scarcity" may occur prior to this date of September 10th.

This question will bear great consideration, and to fix a quantity at this ~~the~~ time without a definite determination of economic use, is rather a matter of conjecture, but rather than avoiding this matter or leaving it open, I submit my judgment as follows:

When the Provo River has receded to and is below an amount that will supply to the primary rights, a quantity to maintain eighty per cent of the amount hereinafter found to be the extent of the economic duty rights, before September 10th. it is then "a time of scarcity", and is subject to distribution according to the "preference rights".

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At the conclusion of this section I wish to impress upon the litigants:

Your right and title to the waters of the Provo River is limited by the extent of beneficial use, under the specific conditions set forth in this section, and which is so well defined by the Hon. Judge Morse.

No Matter what your custom has been in the past, or what amounts you have used, or for how many years, whether it be one or fifty, neither time or quantity, will be a factor in the final determination.

Under the laws of this State, by equity, and by right, you will be given the amount to supply your reasonable necessities, no more, no less.

Duty Defined: The duty of water in irrigation is the area of crop which can be matured with a given volumn. It is the greatest area a unit of water will serve, under practical management, and insure successful crop production.

This term is expressed as a 50 acre duty, a 60 acre duty, meaning 50 and 60 acres respectfully per second-foot of continuous flow.

Factors affecting the duty of water:

- a. The kind and peculiarities of the crop. Crops of different duty requirements throughout this district are diversified in all sections, and varying in different seasons. An area of alfalfa or sugar beets of this year, may be next season planted to grain or orchard. With this ~~factor~~ condition this factor must be considered to cover a general adequate amount covering the general practice and kinds of crops.
- b. The physical character of the soil. Sandy and loose soils require more than the clay and denser soils.
- c. Depth of soil. Shallow soils require more than deep soils.
- d. The character of the sub-soil. Subsoils that affect drainage to great depth at all seasons, require a less duty than sub-soils that become saturated by application of irrigation water.
- e. Frequency of Irrigation. The losses by necessary frequent irrigation are greater than were the applications made at greater intervals.
- f. ~~Frequency~~ Amount and distribution of rainfall.
- g. The amount and time of applying water, and the length of run. Water applied in the night is more efficient than if applied in the day. Water applied during the early growing season, keeping the soil to high moisture content, increase the duty of the available amount in a later period.

On a shallow soil with a porous sub-soil the duty of water varies with the amount applied and the length of run.

Fig.1. represents a cross section of a field (vertical scale exaggerated) irrigated by the flooding method it requires .3 foot for a complete irrigation, or to bring the soil ABHI to full

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moisture content, and provided an even distribution could be made. With an irrigation of four hours duration, the loss by percolation is represented by BDI. The average depth of application is considered as one foot. The depth applied at HI is .3 foot, then the depth applied at ~~AB~~ AD is 1.7 feet, ~~xx~~ were the percolation uniform throughout the whole run. Were this tract divided by another cross-ditch at G, the the loss by deep percolation is BCE and EFI, and the amount of loss EFCD is illiminated, and the amount applied is but two-thirds the ~~depth~~ amount of application when the irrigation was made in one run.

And with this same soil, a shallow soil on a porous sub-soil, the application of 1.7 feet at AD, and the application of .3 foot at HI, 12 hours after the irrigation or when water ceases to percolate into the sub-soil, then the amount of wtaer at HI and AB is the same, that is to say the application of .3 foot is just as efficient as the application of 1.7 feet.

This illustration is assumed, but which is a common condition, and show fairly this factors determination on the duty of water.

h. The Climate.

i. Method of applying water.

j. The Tillage Practice.

k. The time of harvest.

l. And lastly, the skill of the irrigator, the greatest of all factors determining the duty of water.

With all these factors affecting the duty of water, it is not possible to ^{set} any definite amount which should be used by each system ~~xxxxxx~~ until the basic facts ^{are determined} and tests are made ~~minad~~. But at this time it is possible to specify a duty that will be applicable temporarily and which is given with the following conditions imposed:

- a. It must cover the general crops, the soils, and the conditions.
- b. It assumes that all irrigators are competent and diligent.
- c. It leaves no risks to the primary rights.
- d. Is a fair and a reasonable amount, and does not admit of a

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/^{question} of insufficiency.

The question may arise, why do I assume the skill of the irrigator to be perfect? For this reason, the skill, the care, and the diligence of the irrigator, is capable of the highest efficiency, and is required by all users of water, "used economically without waste, and with due care." It is not a physical fact or condition impossible of remedy.

The water ^Psupply is a fixed quantity, and wholly insufficient for the area of land, the irrigator who has been using a one-half duty is depriving an equal amount of land of a water ~~supply~~ supply.

Pending the final adjudication of this case, and the determination of the exact and proper amount/^{necessary} for irrigation, a tentative duty must be in vogue, a definition of the primary rights as against later appropriators, and the distribution of the river flow when the amount is greater and when less than the primary rights.

The actual irrigated area, coupled with the duty determines the rights of the defendants.

The basis of allotment is the irrigated acreage with its necessities, computed on the Net duty (N.D.) The total amount allowed at the measuring station is designated the gross duty which includes the net duty plus the losses in transmission, or the net duty less the inflow between the point of measurement and the point of use. Losses or inflow shall be for canal and main laterals, but no allowance should be made for farm distribution.

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~~Intensified, but no allowance should be made for transmission losses.~~

With this method it will be possible to give to each system a relatively proper net duty, and will correct the existing differences experienced by not taking into account the losses in transmission, or the inflow.

The allowable losses in transmission should be determined by actual test, with all the system in perfect condition, in good order and repair, and in no case, even after determination should a loss be allowed of more than a reasonable and practical amount.

The amount of inflow should be determined by actual tests, at such times as may be necessary.

In this discussion there is recognized two distinct classes of agriculture, viz; extensive farming and intensive farming, and with each class two distinct seasons.

Extensive farming embraces the Provo Valley and all the lands above the mouth of Provo Canyon. The individual ownership of land is great, averaging more than one hundred acres, the crops are of low profitable returns per acre, the irrigator cannot be with each stream of water constantly, night and day, and therefore the irrigated area per unit of water is less, and the water duty correspondingly lower. In this section the general adaptability of land and climate is for raising of grains, hay, and pasture. The season for the hay and ~~grains~~ pasture lands extends over four and one-half months, from May 1st, to September 15th. The season of irrigation for grains begins on June 1st. and ends on August 1st., a period of two months.

Intensive farming embraces the Utah Valley. In this district the individual ownership of land is low, about twenty acres, the irrigator is able and by the kind of crop is necessarily with each irrigation constantly, attending to distribution of flow, at all times, night and day. The crops are of high^{er} marketable value per acre and warrant greater expenditure in production than the crops in the extensive district. Under this care a higher duty may be maintained, and the quantity of water not doing a full efficiency is reduced to a minimum.

The staple crops, are grain, alfalfa, sugar beets, orchards,